NYSERDA Water Furnace Geothermal Heat Pumps Symphony Time Series

April 2015 – November 2016 Dataset

Overview

General Description

Water Furnace is a manufacturer of ground source—or geothermal—heat pumps (GHPs) with numerous Water Furnace systems installed in New York State (NYS). Many of their high performance dual-stage and variable-speed heat pump systems include the Symphony monitoring system. More than 190 heat pumps with Symphony systems were installed in NYS as of August 2016, making a large data set available to evaluate the performance of residential geothermal systems. The data from 50 sites with several months of operation were analyzed to quantify the seasonal heating and cooling efficiency of these GHP systems. It also provides the ability to quantify the profile of ground loop temperatures for a large sample of residential systems, and therefore to further understand the impact that loop configuration and design details have on entering fluid temperatures and seasonal performance.

The data sets for each site were analyzed to understand the performance of GHPs. Two data sets are provided:

- A characteristics dataset that includes facts and details about the home and GHP system at each site.
- A time-series dataset that includes the measured data collected at each site at 15-minute intervals over the monitoring period.

This analysis supported NYSERDA's market transformation activities under the Emerging Technologies and Accelerated Commercialization (ETAC) program. Work was contracted for and sponsored by NYSERDA. The results of this effort are given in NYSERDA report 18-03, "Analysis of Water Furnace Geothermal Heat Pump Sites in New York State with Symphony Monitoring Systems" which is available at **https://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/Other-Technical-Reports**

Data Collection Methodology

Data was collected from 50 residential Water Furnace geothermal heat pump systems located in Upstate New York that have the Symphony monitoring system installed. The selection criteria for including a site in the study were based on the number of months of available data, the percentage of good data quality (related to the quality of the communications connection), and whether the more detailed (performance) data set was collected at the site. Nearly all the sites in this dataset provided close to 12 months of data. Data is transmitted to a server via the homeowner's Wi-Fi internet connection. Data is then saved in a database and presented on a website that summarizes both current and historic performance.

Statistical and Analytic Issues

The time series data is summed and averaged into 15-minute intervals. Some time series records in the data set were not available. Data loss was usually due to a loss of communications connectivity between Symphony hardware and the web site (perhaps due to problems with the home Wi-Fi connection). The final report summarizes the available data records for each site.

Accuracy of the measured data from the sensors on Symphony monitoring system is another important issue. Appendix B in the final report does compare the Symphony readings to hand held measurements, and some differences were noted. Some high-level calculated data in the report (capacity, loads, efficiency) were adjusted based on the difference between published performance data and measured readings.